



ASPECT asteroid spectral imaging satellite proposal to AIDA/AIM CubeSat payload

T. Kohout^{1,2}, A. Näsilä³, T. Tikka⁴, A. Penttilä¹, K. Muinonen^{1,5}, A. Kestilä⁴, M. Granvik¹, E. Kallio⁴

1. Department of Physics, University of Helsinki, Finland (tomas.kohout@helsinki.fi)
2. Institute of Geology, The Czech Academy of Sciences, Prague, Czech Republic
3. VTT Technical Research Centre of Finland, Espoo, Finland
4. Aalto University, Espoo, Finland
5. Finnish Geospatial Research Institute, Masala, Finland



AIDA mission

The joint ESA/NASA AIDA (Asteroid Impact & De-flection Assessment) mission to binary asteroid Didymos consists of AIM (Asteroid Impact Mission, ESA) and DART (Double Asteroid Redirection Test, NASA). DART is targeted to impact Didymos secondary component (Didymoon) and serve as a kinetic impactor to demonstrate deflection of potentially hazardous asteroids. AIM will serve as an observational spacecraft to evaluate the effects of the impact and resulting changes in the Didymos dynamic parameters.

ASPECT

The AIM mission will also carry two CubeSat miniaturized satellites, released in Didymoon proximity. This arrangement opens up a possibility for secondary scientific experiments. ASPECT is one of the proposed CubeSat payloads. ASPECT (Asteroid Spectral Imaging Mission) is one of the CubeSat proposals and aims to study the composition of the Didymos binary asteroid and the effects of space weathering and shock metamorphism in order to gain understanding of the formation and evolution of the Solar System.

CubeSat platform concept

- 3U CubeSat:
 - Payload: VIS-NIR spectral imager (1U)
 - Avionics (1U)
 - Propulsion (1U)
- Semi-autonomous operations and navigation
- Onboard payload data processing
- Aalto-1 and Aalto-2 heritage

VIS-NIR spectral imager payload

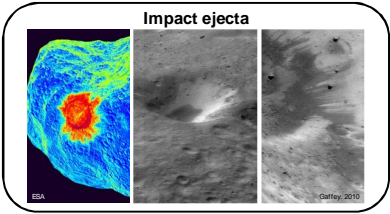
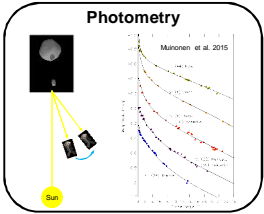
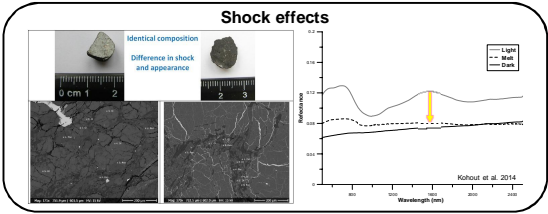
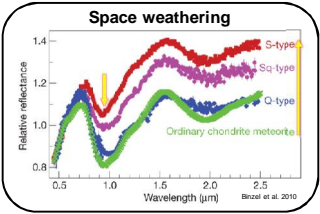
- 3 measurement channels:
 - VIS (500–900 nm) spectral imager (614 x 614 pixels)
 - NIR (900–1600 nm) spectral imager (256 x 256 pixels)
 - SWIR (1600–2500 nm) spectrometer (1 pixel)
- Aalto-1 Spectral Imager heritage
- 30 nm spectral resolution
- Better than 2 m spatial resolution (pixel size) from 4 km orbit

Scientific objectives

1. Study of the surface composition of the Didymos system
2. Photometric observations (and modeling) under varying phase angle and distance
3. Study of space weathering effects on asteroids (comparison of mature / freshly exposed material)
4. Study of shock effects (spectral properties of crater interior)
5. Observations during the DART impact
6. Map fallback ejecta on Didymoon and Didymain

Mission target – Didymos Binary asteroid

- Apollo type NEA (Near-Earth Asteroid)
- S-type composition
- Didymain diameter 780 m, 2.1 g/cm³
- Didymoon diameter 160 m
- Distance between centers 1.2 km
- Orbital period 12 h



Conclusions

ASPECT is a CubeSat mission with a VIS-NIR imaging spectrometer. Main science objectives are to characterize Didymos surface and its changes after DART impact and to significantly improve understanding of space weathering and shock processes.

Acknowledgments

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